

## **CHROME-FREE PASSIVATING SOLUTION**

### **Field of the Invention**

The present invention relates to a solution for passivating  
5 electro-galvanizing coat and hot-galvanizing, and more particularly to a  
chrome-free passivating solution replacing the passivating solution containing  
hexad chrome and trivalent chrome.

### **Description of Prior Art**

10 Electro-galvanizing coat or hot-galvanizing coat must be passivated to  
enhance the corrosion resistance and to achieve a decorative appearance. At  
present, passivation for electro-galvanizing coat and hot-galvanizing coat is  
generally conducted by using chromate passivating solution, with a simple  
passivating process and low cost, to greatly improve the corrosion resistance of  
15 galvanizing coat of steel piece. However, either passive film formed by means of  
chromate passivation or waste chromate passivating solution contains hexad  
chrome, which is seriously harmful for human healthy and environment  
protection. It has been clearly prescribed by Chinese government that the waste  
chromate passivating solution must be treated before being discharged out.  
20 Many industrial sectors both in the country and abroad such as automobile,  
electronics, home appliance etc. also have stipulated to prohibit hexad chrome  
from being contained in the galvanizing coat after a certain time limit, even  
trivalent chrome is also prohibited to be contained in the galvanizing coat in  
some enterprises. Therefore, tremendous efforts have been made to provide a

chrome-free passivating method in which no chromate passivating solution need to be used. A chrome-free passivating solution has been disclosed in a China Patent Application No. 00114178, titled "Chrome-free passivating solution used for protecting galvanizing coat and its coating method". The chrome-free

5 passivating solution is prepared by "innocuous soluble molybdenate selected as inhibitor and innocuous water-soluble acrylic ester solution". Although the passivating solution is chrome-free, it is unable to replace the conventional chromate passivating solution, because the passivating solution must be coated on clean surfaces of galvanized pieces to form surface resin coat rather than

10 really passivating the galvanizing coat. It is impossible to use the conventional chromate passivating equipment for said chrome-free passivating solution of above-mentioned application, so investment cost for equipment will be increased. Furthermore, the surface resin coat easily flakes off from the galvanizing piece so as to decrease its corrosion resistance and surface

15 decorative effect. So far, there is no real chrome-free passivating solution, which can replace the chromate passivating solution.

### **SUMMARY OF THE INVENTION**

The objective of the present invention is to provide a chromate-free

20 passivating solution, which can replace the conventional chromate passivating solution for being used in the process of passivating the galvanizing coat, with substantially the same corrosion resistance as that provided by hexad chrome passivating process.

To achieve the object of the present invention, the present invention

provides a chrome-free passivating solution, each liter of said chrome-free passivating solution comprises the following components:

	Salts containing free element	20~35g
	Complexing agent	18~38g
5	Oxidation reducer	0.05~0.15g
	Water	rest amount

Said salt containing free element is a mixture of two kinds of salts containing free element, and the weight ratio between said two kinds of salts is in the range of 35~45:1.

10 Said salt containing free element is a mixture of one salt containing free element and other inorganic salt with chrome-free, and the weight ratio between said two kinds of salts is in the range of 35~45:1.

Said complexing agent is a mixture of three organic acids, and the weight ratio between three organic acids is 6:5:1.

15 Said complexing agent is a mixture of two organic acids and peroxide, and the weight ratio between two organic acids and peroxide is 6:5:1.

Said oxidation reducer is two inorganic acids, and the weight ratio between two inorganic acids is in the range of 7~10:1.

20 Said salt containing free element is composed of titanium, manganese, and molybdenum.

Said organic acids include citric acid, tartaric acid, pyrophosphate acid, nitrilotriacetic acid, and compound containing 8~28 oxygen atom, 4~16 hydroxy and 2~8 phosphoric acid.

Said inorganic acid consists of sulfuric acid, hydrochloric acid and nitric

acid.

The chrome-free passivating solution of the present invention is made with salts containing free element, complexing agent, oxidation reducer and water by according to a specific proportioning. Compared with the prior art, the present invention not only substantially solves the problem that noxious hexad and trivalent chromes are present in the galvanized coat of the conventional products and the conventional passivating solution, eliminates the harm of the hexad and trivalent chromes to human and environment, really replaces the chromate passivating solution containing hexad and trivalent chrome to complete the passivation of electro-galvanizing coat and hot-galvanizing coat, solves the problem that the surface resin coat easily flakes off, the corrosion resistance of galvanizing coat passivated to the present invention is better than the corrosion resistance by using the conventional blue-white passivating technology, and equal to that by using the color passivating technology, but also can be used with the conventional chromate passivating equipment so as to lower application cost of the passivating solution, and the processing conditions such as temperature, time for passivating process is substantially the same as that of conventional chromate passivation, so tremendous cost for training staff members personnel is saved. Thus, the present invention has great economic benefit and social benefit .

Following is the detailed description of the preferred embodiment.

[Example 1]

Take 20g of salts containing free element such as potassium permanganate, titanyl sulfate and ammonium molybdate , 38g of complexing

agent for example citric acid, 0.15g of oxidation reducer such as sulfuric acid, and mix these materials with water to prepare one liter of passivating solution with pH value of 1-3. The passivation operating condition is the same as that of the conventional chromate passivating technology. Under the room temperature, the galvanizing coat is immersed in the passivating solution for 4-10 seconds, then rinsed, dried and baked to gradually form passive film with Cambridge blue and jade-green.

[Example 2]

Take 3500g of salts containing free element, which is a mixture of ammonium molybdate and potassium permanganate with the weight ratio 35:1, namely taking ammonium molybdate of 3402.78g, and potassium permanganate of 97.22g, and take 1800g of complexing agent of tartaric acid, 5g of oxidation reducer of hydrochloric acid, then mix these materials with water to obtain 100 liter of passivating solution with pH value of 1-3.

The passivation process is the same as the example 1.

[Example 3]

Take 200 of salts containing free element, which is a mixture of ammonium molybdate and sodium silicate with the weight ratio 45:1, namely taking ammonium molybdate of 195.65g, and sodium silicate of 4.35g, and take 38g of complexing agent of pyrophosphate acid, 1.5g of oxidation reducer of nitric acid, then mix these materials with water to obtain 10 liter of passivating solution with pH value of 1-3.

The passivation process is the same as the example 1.

[Example 4]

Take 3000g of salt containing free element, which could be made in accordance with any proportioning described in the example 1, 2, or 3, 2000g complexing agent, which is a mixture of three organic acid of which includes citric acid, tartaric acid and diphosphoric with the weight ratio 6:5:1, namely  
5 1000g of citric acid, 833g of tartaric acid, and 167g of diphosphoric acid, take 7g of oxidation reducer, which could be nitric acid, hydrochloric acid or sulfuric acid, and mix these materials with water to obtain 100 liters of passivating solution with pH value of 1-3.

The passivation process is the same as the example 1.

10 [Example 5]

Take 2500g of salts containing free element (the same as example 4), 2500g of complexing agent, which is a mixture of two organic acid of which could be diphosphoric acid and sodium triglycollamate or compound containing 8~28 oxygen atom, 4~16 hydroxy and 2~8 phosphoric acid, and peroxide with  
15 the weight ratio 6:5:1, namely 1250g of diphosphoric acid, 1042g of sodium triglycollamate, 208g of sodium peroxide, and take 5g of oxidation reducer of which could be nitric acid, hydrochloric acid or sulfuric acid, and mix these materials with water to obtain 100 liters of passivating solution with pH value of 1-3.

20 The passivation process is the same as the example 1.

[Example 6]

Take salts containing free element and complexing agent same as example 4 or 5, and the oxidation reducer is two inorganic acid such as sulfuric acid and hydrochloric acid, sulfuric acid and nitric acid, hydrochloric acid and

sulfuric acid with the weigh ratio in the range of 7~10:1. Namely, if taking 5g of oxidation reducer, one inorganic acid is of 0.625g, the other is of 4.375g; or one is of 0.45g, the other is of 4.55g. Then mix these materials with water to obtain 100 liters of passivating solution with pH value of 1-3.

5           The passivation process is the same as the example 1.

A multiple structure chrome-free passive film in the galvanizing coat is formed by salts containing transmittion metal such as molybdenum, manganese and titanium, and complexing agent in the present invention reacting on the galvanizing coat. Through samples tests for the corrosion resistance of  
10 chromate-free passivating solution according to the present invention, it shows that the passivating technology is stable and practicable, and in accordance with standard completely.

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